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Article 1: Evaluation

1. You receive a request to evaluate a 22-year-old college student who was found to have a BP of 158/99 mmHg at the dentist's office. Because of her final examination schedule, she cannot come to your office to be seen for another month.

What is the next best step in the management of this patient?

- A. Initiate amlodipine 5 mg daily so that you can assess if she needs additional therapy when she presents for her visit
 - B. Recommend that she obtain kiosk-based BP measurements at her local supermarket until she is able to come into the clinic to be evaluated
 - C. Recommend that she purchase a validated home BP monitor and provide her with guidance on appropriate measurement technique
 - D. Initiate losartan-hydrochlorothiazide 25 to 12.5 mg daily so that you can assess if she needs additional therapy when she presents for her visit
2. You have been following a 68-year-old man for several years who has a history of stable proteinuric CKD Stage IV, hypertension, heart failure with preserved ejection fraction, and hypothyroidism. His BP has been at or below his goal in the office for the past 6 years on valsartan 320 mg daily, chlorthalidone 25 mg daily, and amlodipine 5 mg daily. He presents to clinic noting that he recently purchased a home BP monitor, which has been showing BPs consistently 10 to 15 mmHg above his goal.

Which of the following is the best response to this patient's home readings?

- A. Ignore the readings, given that his BPs are consistently well controlled in the office
 - B. Suggest that he stop monitoring his BP at home because you suspect he is not able to use appropriate measurement technique
 - C. Add spironolactone for improved BP control because of the presence of masked uncontrolled hypertension
 - D. Recommend 24-hour ambulatory BP monitoring (ABPM) to confirm the presence of masked uncontrolled hypertension
3. A new patient presents for evaluation of asymptomatic labile BPs at home ranging from the 80s/30s mmHg to 190s/110s mmHg using his new cuffless watch, which was advertised by his favorite technology magazine as being the top new device on the market for monitoring BP.

Which of the following is the best approach to this patient's BP measurement?

- A. Recommend that he undergo 24-hour ABPM
- B. Encourage him to continue to monitor his BP at home using this device because BP monitors cannot be marketed unless they are accurate
- C. Recommend that he undergo evaluation for autonomic dysfunction

- D. Recommend that he obtain a kiosk-based BP measurement at his local supermarket until he is able to come into the clinic to be evaluated

4. A 44-year-old man is referred to you for a hypertension evaluation. Your office assistant has recorded two seated BPs averaging 142/91 mmHg.

Which of the following questions is most likely to be helpful when considering a secondary component in the BP elevation?

- A. How many steps a day do you typically walk?
 - B. How many meals do you eat at home in a typical week?
 - C. What medications or drugs, prescription or otherwise, are you using?
 - D. Have you recently traveled to a third-world country?
5. A 53-year-old untreated woman is referred from a local hospital health fair when she was noted to have a high BP and an elevated random glucose value. In your office today her BP averages 158/78 mmHg, and her body mass index (BMI) is 27.3 kg/m². She does not have a primary care doctor, and cannot recall a prior BP value because she has felt fine and "did not see the need to check it."

Which of the following items in your initial evaluation of her case is most likely to identify nonhypertensive-related cardiovascular risk factors important for you to know in selecting therapy for her BP elevation?

- A. Low white blood cell count
 - B. A urine dipstick registering ++ protein
 - C. Electrocardiogram showing right bundle branch block
 - D. Elevated C-reactive protein
6. In evaluating a 61-year-old patient new to your practice, you observe that he has elevated BP readings averaging 163/94 mmHg in your office, and similar values at home. You learn that he had a heart attack with a percutaneous coronary intervention 8 months ago. Shortly after that, he lost his job and health care benefits and disappeared from care for a time. He has recently gotten a new job and is now insured again.

When you explain to him what you are thinking about his BP, which of the following statements would most accurately summarize his current situation?

- A. "Now that you have had a heart attack, we can relax a bit because the damage is behind you, and we will spend the next months working on your weight and your physical activity level"
- B. "Now that you have had a heart attack, we need to be cautious about not lowering your lower BP number (diastolic) too much because we don't want to cause another heart attack"
- C. "Now that you have had a heart attack, your body is showing us that it is vulnerable to things like an elevated BP, and we really need to work hard to get this under control soon"

D. “Now that you have had a heart attack, we believe that the upper BP number (systolic) should be 100 + your age in years, and your current upper number of 163 mmHg is about where it should be”

7. You are following a 73-year-old man with stage 4 CKD, diabetes, and hypertension. Office and home readings have always varied substantially from reading to reading. The patient states that his BP always goes up because of traffic on the way to clinic, and he is not sure his home BP cuff works correctly. You obtain ABPM, which shows marked variability, but most readings are within target range.

Which of the following is likely to be true regarding his BP variability based on current data?

- A. Because most of his ABPM readings are within range, his BP is considered well controlled
 - B. Although short-term BP variability as measured by ABPM is worrisome, long-term BP variability using office or home readings has not been shown to be associated with the risk of cardiovascular events or mortality
 - C. Although long-term BP variability using office or home readings is worrisome, short-term BP variability as measured by ABPM has not been shown to be associated with the risk of cardiovascular events or mortality
 - D. He is at increased risk for a major adverse cardiovascular event or death
8. A 48-year-old woman is referred for difficult-to-control hypertension. The following drugs have been tried and stopped because of side effects: amlodipine (edema), metoprolol (excessive fatigue), chlorthalidone (severe hypokalemia). Her BP is improved but still elevated at 152/96 mmHg on losartan 100 mg. Her family history is notable for her father, who has severe hypertension, diabetes, and CKD; her mother is healthy and normotensive. She has no history of pulmonary edema, and the results of physical examination are unremarkable. She is afraid to try spironolactone because she read about the risk of hyperkalemia.

What is the next best step?

- A. Reassure her and start spironolactone with careful monitoring of potassium
- B. Start clonidine or hydralazine because she may tolerate them better
- C. Retry a lower dose of chlorthalidone and monitor the potassium
- D. Evaluate her for primary aldosteronism

Article 2: Management

9. A 77-year-old woman with a history of hypertension for the past 15 years comes to clinic for review. She is currently treated with amlodipine and losartan, and her clinic BP today is 132/85 mmHg. She has a family history of dementia, and had a previous magnetic resonance imaging of her brain to investigate a transient ischemic attack 3 years ago, which showed early white matter changes without focal infarction. She feels very well and has excellent functional status, without symptoms of cognitive impairment. However, given her family history, she asks if there is anything additional that can be done to reduce her risk of dementia.

Regarding the effect of tight BP control on the development of cognitive impairment, which of the following is correct?

- A. Tighter BP control (target systolic BP <120 mmHg) has been associated with reduced progression of white matter changes, without changes in overall brain volume
 - B. Intensive BP control was associated with reduced risk of mild cognitive impairment at 5 years follow-up
 - C. Tighter BP control was associated with higher rates of falls, as compared with standard control, in patients with underlying cerebrovascular disease
 - D. Intensive BP control was associated with reduced cerebral perfusion in those with small-vessel cerebrovascular disease
10. A 32-year-old woman is found to have a BP of 148/92 mmHg on screening BP at an insurance medical examination. She is overweight and sedentary, with a high-salt diet. You recommend lifestyle changes as the initial step. Four months later, she returns to clinic. She is now on a low-salt diet and has lost 15 pounds through diet and exercise. Her BP today is 142/88 mmHg. You recommend that she continue her lifestyle changes, but also start taking antihypertensive medication.

When choosing a first-line agent for treatment of hypertension, which of the following is correct?

- A. Dihydropyridine and nondihydropyridine calcium channel blockers were similarly effective in reducing complications related to hypertension
 - B. Chlorthalidone and hydrochlorothiazide had similar effects on rates of myocardial infarction, heart failure, and stroke, and have similar adverse effect profiles
 - C. Treatment with thiazide diuretics has been associated with better BP control and reductions in cardiovascular outcomes, as compared with other first-line agents for management of hypertension
 - D. Compared with other first-line agents, treatment with angiotensin-converting enzyme (ACE) inhibitors led to the greatest reduction in rates of stroke and hospitalization for heart failure
11. A 54-year-old man is referred to your clinic for assessment of hypertension. He has been taking valsartan for 6 months, and his BP remains above goal at 144/92 mmHg. His 24-hour ABPM reveals similar ambulatory BP readings. You discuss with him the need to add another agent to control his BP. The patient refuses and instead wishes to switch to a different medication because this one is “not working.”

Which of the following is correct regarding combination therapy for the treatment of hypertension?

- A. As compared with monotherapy, initiation of combination antihypertensive therapy is associated with reduced mortality at 3-year follow-up.
- B. In African patients with uncontrolled hypertension, combination therapy with perindopril/hydrochlorothiazide led to improved BP control as compared with perindopril/amlodipine
- C. Two-drug combination therapies are preferred to triple therapy because higher rates of adverse events are seen with triple therapy combinations

D. Observational data suggest that the majority of patients started on a single agent for treatment of hypertension end up on a combination agent by 3 years follow-up

12. A 72-year-old woman with hypertension comes to clinic for BP follow-up. She is currently treated with amlodipine and losartan, and her clinic BP today is 136/78 mmHg. Her serum creatinine is 0.8 (estimated GFR 74 mL/min per 1.73 m²), and spot urine is negative for microalbuminuria. She lives independently and feels very well, with excellent functional status. Based on the Systolic Blood Pressure Intervention Trial (SPRINT) and the 2017 American College of Cardiology / American Heart Association (ACC/AHA) high BP guideline, you recommend adding a third medication to lower her BP to <130/80 mmHg, change her losartan to losartan/hydrochlorothiazide, and schedule follow-up in 2 weeks. At her follow-up visit, BP is 128/72 mmHg, and she feels well. Her potassium has declined from 4.6 to 3.8 mEq/L. However, her serum creatinine has increased to 1.1 mg/dL, with a decline in her estimated GFR by 30% to 50 mL/min per 1.73 m².

Regarding the effect of tight BP control on kidney function, which of the following is correct?

- A. Intensive BP control (target systolic BP <120 mmHg) that leads to acute kidney injury in patients without prior CKD is likely to progress to ESRD
 - B. Intensive BP control in SPRINT was associated with a small but persistent decline in GFR compared with standard BP control
 - C. Intensive BP control was associated with higher levels of kidney injury biomarkers, indicating permanent kidney damage
 - D. Intensive BP control was associated with reduced renal endpoints of ESRD or 50% decline in GFR
13. A 60-year-old man is referred after two sets of BP measurements were noted to be elevated at a BP screening. He has smoked one pack per day for 40 years but is otherwise well. His BMI is 32 kg/m², and BP 136/86 mmHg in both arms, but the results of his examination are otherwise negative. His total cholesterol is 220 mg/dL, with HDL 40 mg/dL and LDL 160 mg/dL. Electrolytes are normal, and the result of urinalysis is negative.

Regarding the initial approach to treatment recommendations, which of the following is correct?

- A. He should be instructed on lifestyle modification alone with follow-up in 3 months
 - B. He should be started on lifestyle modification and medication with follow-up
 - C. He should be instructed on lifestyle modification with the decision on medication dependent on assessment of 10-year cardiovascular disease event risk
 - D. He should be started on a combination medication to bring him quickly to his target BP
14. A 53-year-old African American man is referred for treatment of uncontrolled hypertension. He has CKD stage 3 with estimated GFR 45 mL/min, a urine protein/creatinine ratio of 1 g/g, and a strong family history of hypertension and ESRD. His BP is 159/92 mmHg, with a heart rate of 55 beats/min. Medications include chlorthalidone 50 mg daily, losartan 100 mg daily, and amlodipine 10 mg daily.

What is the best next action to adjust his regimen to control his BP?

- A. Chlorthalidone should be discontinued because it is less effective at this GFR
 - B. An ACE inhibitor should be added for additional anti-proteinuric effect
 - C. A β -blocker is the most appropriate next agent
 - D. Spironolactone is the most appropriate next agent
15. A 59-year-old man is referred to you for severe hypertension and multiple drug intolerances. He is taking hydralazine 25 mg four times daily, furosemide 40 mg twice daily, lisinopril 40 mg daily, and labetalol 200 mg three times daily. In clinic, his BP is 164/92 mmHg. By his report, he often forgets doses of medication during the day.

Which of the following is true regarding suboptimal adherence to antihypertensive medication?

- A. Around 25% of patients show nonadherence or suboptimal adherence to antihypertensive medications
- B. Using electronic health record medication management tools plus nurse-led patient education improves medication adherence
- C. Smartphone apps that provide reminder alerts, adherence reports, and peer support may lead to improved BP control
- D. Smartphone apps that provide reminder alerts, adherence reports, and peer support may improve medication adherence

Article 3: Epidemiology

16. You are asked to give a public health presentation on the global burden of hypertension at an international conference.

Which of the following statements is correct regarding recent trends in deaths and disability-adjusted life years (DALYs) or years of ill health globally due to hypertension?

- A. Number of hypertension-related deaths increased by about 50% between years 2007 and 2017
 - B. Number of hypertension-related DALYs reduced by about 15% between years 2007 and 2017
 - C. Both overall number and age-standardized rates of deaths and disability related to hypertension continued to rise between years 2007 and 2017
 - D. Number of deaths and disability related to hypertension continued to rise while age-standardized rates declined between years 2007 and 2017
17. Based on the recent guidelines for hypertension diagnosis, a colleague has observed an almost doubling of younger patients (<40 years old) diagnosed with hypertension. He is concerned whether or not these patients are actually at risk of complications from hypertension.

Which of the following should you tell your colleague about risk of cardiovascular disease in young newly diagnosed hypertensive patients?

- A. Patients with BP of \geq 130/80 mmHg before the age of 40 years are at increased risk of cardiovascular disease
- B. Patients with BP of \geq 130/80 mmHg before the age of 40 years are not at increased risk of cardiovascular disease

- C. Only men with BP of $\geq 130/80$ mmHg before the age of 40 years are at increased risk of cardiovascular disease
- D. Only women with BP of $\geq 130/80$ mmHg before the age of 40 years are at increased risk of cardiovascular disease

18. The 2017 ACC/AHA Blood Pressure Guideline revised the definition of hypertension and are expected to influence the prevalence of hypertension in the community. As part of a planning process to allocate resources to manage hypertension within your hospital, a colleague in hospital leadership asks you to explain the impact of these guidelines.

Which of the following best reflects the current estimates of the impact of the 2017 ACC/AHA Blood Pressure Guideline?

- A. The number of people with hypertension will increase by only $<2\%$ of the adult US population
 - B. Hypertension prevalence will increase by almost fivefold in older people (>65 years)
 - C. Hypertension prevalence will increase by about 30%, and every newly diagnosed patient will receive recommendation for antihypertensive medication
 - D. Recommendation for antihypertensive medication will increase by only $<2\%$ of the adult US population
19. A 52-year-old man with hypertension and diabetes is seen during a routine clinic visit. His office BP is 149/97 mmHg, and he is on antihypertensive medications. He also reports a history of severe periodontitis. You advise him to escalate antihypertensive drug therapy.

Based on recent studies on BP and periodontitis, which of the following is correct?

- A. Antihypertensives may be less effective in the presence of periodontitis
 - B. Severe periodontitis is associated with a doubling of incidence of hypertension
 - C. Periodontitis does not predict BP control
 - D. Treating the patient's periodontitis will not alter his BP control
20. A 71-year-old white woman presents with office BP of 85/57 mmHg. She reports having had high BP in her 40s and 50s. She recently read a report in the newspaper about people with problematic BP developing dementia.

Based on a recent study on chronicity of high BP and dementia, which of the following should you tell her regarding risk of dementia in patients of her age?

- A. Low BP in patients her age is not linked to dementia
 - B. Low BP in patients her age is linked to dementia if patients have a history of high BP
 - C. Low BP in patients her age is linked to dementia only if patients are African Americans and have a history of high BP
 - D. Low BP in patients her age is linked to dementia only if patients are genetically susceptible to dementia and have a history of high BP
21. A 48-year-old man with suspected masked hypertension recently completed 24-hour ABPM. His 24-hour ambulatory BP was 145/98 mmHg. He does not smoke, leads a fairly active life, and does not have a family history of hypertension. He works for an insurance

company and works more than 55 hours per week. He wants to know if he should be concerned about his long work hours.

Which of the following should you tell him?

- A. Assure him that long working hours have no relationship with hypertension
 - B. Assure him that long working hours are associated with hypertension only if someone has a family history of hypertension
 - C. Assure him that long working hours are associated with hypertension only if someone leads a sedentary lifestyle
 - D. Assure him that long working hours are associated with both masked hypertension and sustained hypertension
22. At an international conference on hypertension and cardiovascular disease, you hear a speaker discuss the prevalence of hypertension and its complications in a developing country. She also describes the patterns observed across differing levels of income and education.

Which of the following statements is true regarding the association between socioeconomic status and hypertension?

- A. Across all economic regions, hypertension is more common among individuals of lower socioeconomic status
 - B. Hypertension generally correlates with the prevalence of obesity and physical inactivity
 - C. Individuals of lower socioeconomic class and education generally have lower risk of both hypertension and cardiovascular disease
 - D. Control of hypertension is higher among those of lower socioeconomic class
23. A 47-year-old patient comes for his annual physical with his primary care physician, and his BP is 140/92 mmHg. He is a nonsmoker, his BMI is 24 kg/m², and he has no family history of early-onset hypertension or cardiovascular disease. He works in advertising and reports that his job requires long hours and frequent travel. He reports he has "no time to exercise" and relaxes by having one or two alcoholic drinks each evening. You begin to discuss lifestyle changes with him as an initial step to address his hypertension. He asks you if there are any reliable data linking alcohol intake and "working too hard" to hypertension.

Which of the following is true?

- A. Definitive studies have shown that light or moderate alcohol intake lowers the risk of hypertension
- B. Observational data suggest that working >48 hours weekly is associated with increased risk of hypertension compared with working <35 hours weekly
- C. Observational data suggest that working >48 hours weekly is associated with increased risk of masked hypertension but not sustained hypertension
- D. A study of genetic variants that predict alcohol intake suggests that alcohol intake is negatively associated with hypertension risk

Article 4: Mechanism/Pathophysiology

24. A 19-year-old woman presents with sudden-onset anxiety and complains her heart is "fluttering." Physical examination reveals tachycardia and BP of 157/93. Urinary analysis reveals increased

metanephrine excretion, and a retroperitoneal mass is identified with subsequent CT imaging.

Assuming there is a reduced fractional excretion of sodium, which of the following is directly contributing to the sodium retention occurring in this patient?

- A. Renal tubular α -adrenergic receptors
- B. Juxtaglomerular α -adrenergic receptors
- C. Preganglionic β -adrenergic receptors
- D. Vascular α -adrenergic receptors
- E. Cardiac β -adrenergic receptors

25. A novel antihypertensive therapy is developed using a viral vector engineered to target the juxtaglomerular apparatus. Preliminary studies in healthy subjects found a significant reduction in plasma renin activity, reduced circulating (pro)renin levels, reduced urinary excretion of prostaglandin E-2 metabolites, and a modest (8 mmHg) reduction in BP. Plasma osmolality and electrolytes were unaltered.

Which of the following is the most likely mechanism by which this novel therapy is eliciting an antihypertensive effect?

- A. Decreased expression of sodium-potassium-chloride cotransporter
- B. Decreased expression of the (pro)renin receptor
- C. Increased expression of ACE
- D. Increased expression of angiotensin II receptor type 1

26. A 46-year-old man presents to his primary care provider for an annual visit. His BMI has gradually increased over the past 5 years from 33.4 to 37.6, and his BP increased from 124/83 to 138/85 mmHg. Other aspects of his physical examination and history are unremarkable.

Which of the following best describes the components of the AHA's DASH diet that would be beneficial in combating the gradual increase of BP in this patient?

- A. Increased sodium delivery to the collecting duct epithelial sodium channel to stimulate potassium excretion
- B. Decreased concentration of bicarbonate in the tubular filtrate
- C. Decreased pH in the tubular lumen increasing sodium-hydroxy exchanger activity
- D. Increased activation of sodium transporters throughout the nephron

27. A 53-year-old man presents to his primary care provider for an annual visit. His BP values have gradually increased from 124/83 to 148/85 mmHg over the past 8 years. Other aspects of his physical examination and history are unremarkable.

Based on recent mechanistic studies, which of the following is most likely to be true regarding circulating extracellular vesicles from this patient?

- A. Extracellular vesicles (EVs) do not influence vascular tone
- B. EVs from this patient will cause direct vasoconstriction as compared with EVs from a normotensive individual
- C. EVs from normotensive patients cause direct vasodilation as compared with EVs from this patient
- D. EVs from this patient will reduce acetylcholine-induced vasodilation as compared with EVs from a normotensive individual

E. Prior destruction of EVs from this patient will reduce acetylcholine-induced vasodilation

28. A 28-year-old man presents to his primary care provider because of fatigue, his spouse's concerns with snoring, and BP of 136/85 mmHg. A sleep study is performed, and obstructive sleep apnea is confirmed. The patient's BP is reduced to 125/83 mmHg during 3-month follow-up with appropriate use of continuous positive airway pressure (CPAP).

Which of the following best describes the physiologic mechanism resulting in reduced BP in this patient after regular use of CPAP?

- A. Increased circulating norepinephrine concentration
- B. Increased plasma angiotensin II concentrations
- C. Increased urinary aldosterone concentration
- D. Decreased activity of renal nerves
- E. Decreased urinary sodium excretion

29. You are evaluating a 39-year-old man with resistant hypertension and severe obstructive sleep apnea (OSA). He is taking four medications including chlorthalidone, amlodipine, losartan, and spironolactone. His BP remains at 149/89 mmHg. He has marked difficulty wearing a CPAP mask. He has seen an article online and asks if renal denervation might help his hypertension or sleep apnea.

Which of the following is correct regarding renal denervation, hypertension, and sleep apnea, based on current data?

- A. Because hypertension is the result of OSA, there may be a benefit of renal denervation on hypertension, but there is no reason to suggest that renal denervation would affect OSA itself
- B. The studies on renal denervation excluded patients with OSA, so a benefit of denervation on OSA patients cannot be predicted
- C. Renal denervation may decrease hypertension and the severity of OSA
- D. Improved compliance with CPAP would have a greater effect on his BP than renal denervation

30. You are giving a talk on diet and hypertension at a local chapter of the National Kidney Foundation. A member of the audience says, "I read on the internet that all kidney patients should eat as little potassium as possible. Does potassium have any effect on BP?"

Which of the following is likely to be true regarding potassium intake and BP?

- A. No correlations have been observed between potassium intake and CKD progression
- B. Hypertension correlates better with the dietary sodium/potassium ratio than with sodium intake alone
- C. Potassium restriction increases natriuresis in animal studies, especially in CKD
- D. Potassium restriction increases sodium delivery to the distal tubule